CLAIMS

1. A system for use in guiding an object, in particular an elongate object, into a region of interest which is reached by maneuvering between structures, the system comprising:
at least one emitter array for emitting an output;
at least one receiver array for receiving an input;
a drive unit operably connected to the at least one emitter array to drive the same to emit an output;
an acquisition unit operably connected to the at least one receiver array to acquire an input as received thereby;
a modeling unit for modeling the input as acquired by the acquisition unit to identify structures as obstacles to guiding of the object;
a path determination unit for determining an obstacle-free path between the identified obstacle structures; and
an indicator unit for indicating to an operator whether the object is being guided in accordance with the obstacle-free path.

2. The system of claim 1, wherein the at least one emitter array is configured to emit an ultrasonic output and the at least one receiver array is configured to receive an ultrasonic input.

3. The system of claim 1, wherein the at least one emitter array is configured to emit an X-ray output and the at least one receiver array is configured to receive an X-ray input.

4. The system of claim 1, wherein the at least one emitter array is configured to emit an NMR output and the at least one receiver array is configured to receive an NMR input.

5. The system of any of claims 1 to 4, wherein the drive unit is configured to drive the at least one emitter array to emit an output of varying phase.

6. The system of claim 5, wherein the acquisition unit is configured to store the input as a three-dimensional grid and assign sections of the grid based on interpreted density values.

7. The system of any of claims 1 to 6, wherein the path determination unit is operative repeatedly to determine an obstacle-free path.

8. The system of any of claims 1 to 7, wherein the indicator unit is configured to provide a visual indication to the operator.

9. The system of any of claims 1 to 8, wherein the indicator unit is configured to provide an audible indication to the operator.

10. The system of any of claims 1 to 9, wherein the indicator unit is configured to provide a first indication where a location and/or angle of approach of the object is close, preferably within a predetermined limit, to an edge of a window as defined by the obstacle-free path.

11. The system of claim 10, wherein the indicator unit is configured to provide a second indication where a location and/or angle of approach of the object is outside a window as defined by the obstacle-free path.

12. The system of any of claims 1 to 11, wherein the at least one emitter array and the at least one receiver array are implemented in a single array element.

13. The system of any of claims 1 to 12, wherein the at least one emitter array and the at least one receiver array are housed in a single transducer element.

14. The system of any of claims 1 to 13, wherein the object comprises a needle, the region of interest comprises an epidural cavity and the structures comprise bone structures.

15. A system for guiding an object, in particular an elongate object, into a region of interest which is reached by maneuvering between structures, the system comprising:
at least one emitter array for emitting an output;
at least one receiver array for receiving an input;
a drive unit operably connected to the at least one emitter array to drive the same to emit an output;

an acquisition unit operably connected to the at least one receiver array to acquire an input as received thereby;
a modeling unit for modeling the input as acquired by the acquisition unit to identify structures as obstacles to guiding of the object; and
a path determination unit for determining an obstacle-free path between the identified obstacle structures in accordance with which the object is in use guided.

16. The system of claim 15, wherein the at least one emitter array is configured to emit an ultrasonic output and the at least one receiver array is configured to receive an ultrasonic input.

17. The system of claim 15, wherein the at least one emitter array is configured to emit an X-ray output and the at least one receiver array is configured to receive an X-ray input.

18. The system of claim 15, wherein the at least one emitter array is configured to emit an NMR output and the at least one receiver array is configured to receive an NMR input.

19. The system of any of claims 15 to 18, wherein the drive unit is configured to drive the at least one emitter array to emit an output of varying phase.

20. The system of claim 19, wherein the acquisition unit is configured to store the input as a three-dimensional grid and assign sections of the grid based on interpreted density values.

21. The system of any of claims 15 to 20, wherein the path determination unit is operative repeatedly to determine an obstacle-free path.

22. The system of any of claims 15 to 21, wherein the at least one emitter array and the at least one receiver array are implemented in a single array element.

23. The system of any of claims 15 to 22, wherein the at least one emitter array and the at least one receiver array are housed in a single transducer element.

24. The system of any of claims 15 to 23, wherein the object comprises a needle, the region of interest comprises an epidural cavity and the structures comprise bone structures.

25. A transducer element comprising a body element which is to be located on a surface of a body, a projecting element which extends from the body element and is configured in use to pierce the body and be located therewithin, and at least one transducer array which is disposed in the projecting element.

26. The transducer element of claim 25, wherein the at least one transducer array comprises at least one emitter array and at least one receiver array.

27. The transducer element of claim 25, wherein the transducer array comprises at least one emitter array.

28. The transducer element of claim 25, wherein the transducer array comprises at least one receiver array.

29. A coupling assembly for movably coupling a device, which includes a body and an elongate object extending therefrom, to a mounting pad, the coupling assembly comprising a connector to which the body of the device is connected and a flexible attachment member which connects the connector to the mounting pad such as to allow for movement of the device relative to the mounting pad.

30. The coupling assembly of claim 29, wherein the attachment member is configured to facilitate controlled movement of the device both axially and laterally relative to the mounting pad.

31. The coupling assembly of claim 30, wherein the connector is fixedly connected to the body of the device.

32. The coupling assembly of claim 31, wherein the connector is slideably connected to the body of the device.

33. The coupling assembly of any of claims 30 to 32, wherein the attachment member comprises a bellows structure.

34. The coupling assembly of any of claims 29 to 33, wherein the mounting pad is for attachment to a body, such as by a glue or an adhesive tape.

35. The coupling assembly of any of claims 29 to 34, wherein the mounting pad comprises a rigid body.

36. The coupling assembly of any of claims 29 to 34, wherein the mounting pad comprises a semi-rigid body.

37. The coupling assembly of any of claims 29 to 34, wherein the mounting pad comprises a flexible body.

38. The coupling assembly of any of claims 29 to 37, further comprising a transducer assembly which comprises the mounting pad and at least one transducer array mounted thereto.

39. The coupling assembly of claim 38, wherein the transducer assembly comprises a plurality of transducer arrays.

40. A transducer assembly for attachment to a surface of a body, the transducer assembly comprising a mounting pad which includes an aperture through which an object is insertable, and at least one transducer array.

41. The transducer assembly of claim 40, comprising a plurality of transducer arrays.

42. The transducer assembly of claim 41, wherein the aperture comprises an elongate slot and the transducer arrays are disposed to opposed sides of the slot.

43. The transducer assembly of any of claims 40 to 42, wherein the mounting pad is for attachment to the body by a glue or an adhesive tape.

44. The transducer assembly of any of claims 40 to 43, wherein the mounting pad is for attachment to the body by a vacuum.

45. The transducer assembly of any of claims 40 to 44, wherein the mounting pad comprises a rigid body.

46. The transducer assembly of any of claims 40 to 44, wherein the mounting pad comprises a semi-rigid body.

47. The transducer assembly of any of claims 40 to 44, wherein the mounting pad comprises a flexible body.

48. The transducer assembly of claim 47, wherein the mounting pad comprises a tape.

49. An elongate element for insertion into a body, the element incorporating at least one transducer array.

50. The element of claim 49, wherein the element incorporates at least one emitter array.

51. The element of claim 49, wherein the element incorporates at least one receiver array.

52. The element of claim 49, wherein the element incorporates a plurality of transducer arrays.

53. The element of claim 52, wherein the element incorporates at least one emitter array and at least one receiver array.

54. The element of any of claims 49 to 53, wherein the at least one transducer array is located at a tip region of the element.

55. The element of any of claims 49 to 54, wherein the element comprises a tubular element, in particular a needle.

56. An elongate element for insertion into a body, the element incorporating at least one transponder.

57. The element of claim 56, wherein the at least one transponder is located at a tip region of the element.

58. The element of claim 56 or 57, wherein the element comprises a tubular element, in particular a needle.

59. A method for use in guiding an object, in particular an elongate object, into a region of interest which is reached by maneuvering between structures, the method comprising the steps of:
emitting an output to the region of interest;
receiving an input from the region of interest;
acquiring the input as received;
modeling the acquired input to identify structures as obstacles to guiding of the object;
determining an obstacle-free path between the identified obstacle structures; and
indicating to an operator whether the object is being guided in accordance with the obstacle-free path.

60. The method of claim 59, wherein the output is an ultrasonic output and the input is an ultrasonic input.

61. The method of claim 59, wherein the output is an X-ray output and the input is an X-ray input.

62. The method of claim 59, wherein the output is an NMR output and the input is an NMR input.

63. The method of any of claims 59 to 62, wherein the output has varying phase.

64. The method of claim 63, wherein the acquiring step comprises the steps of:
storing the input as a three-dimensional grid; and
assigning sections of the grid based on interpreted density values.

65. The method of any of claims 59 to 64, wherein determining step comprises the step of:
repeatedly determining an obstacle-free path between the identified obstacle structures.

66. The method of any of claims 59 to 65, wherein the indicating step comprises the step of:
visually indicating to an operator whether the object is being guided in accordance with the obstacle-free path.

67. The method of any of claims 59 to 66, wherein the indicating step comprises the step of:
audibly indicating to an operator whether the object is being guided in accordance with the obstacle-free path.

68. The method of any of claims 59 to 67, wherein the indicating step comprises the step of:
providing a first indication where a location and/or angle of approach of the object is close, preferably within a predetermined limit, to an edge of a window as defined by the obstacle-free path.

69. The method of claim 68, wherein the indicating step comprises the step of:
providing a second indication where a location and/or angle of approach of the object is outside a window as defined by the obstacle-free path.

70. The method of any of claims 59 to 69, wherein the at least one emitter array and the at least one receiver array are implemented in a single array element.

71. A method of guiding an object, in particular an elongate object, into a region of interest which is reached by maneuvering between structures, the method comprising the steps of:
emitting an output to the region of interest;
receiving an input from the region of interest;
acquiring the input as received;

modeling the acquired input to identify structures as obstacles to guiding of the object;

determining an obstacle-free path between the identified obstacle structures; and

guiding the object in accordance with the obstacle-free path.

72. The method of claim 71, wherein the output is an ultrasonic output and the input is an ultrasonic input.

73. The method of claim 71, wherein the output is an X-ray output and the input is an X-ray input.

74. The method of claim 71, wherein the output is an NMR output and the input is an NMR input.

75. The method of any of claims 71 to 74, wherein the output has varying phase.

76. The method of claim 75, wherein the acquiring step comprises the steps of:

storing the input as a three-dimensional grid; and

assigning sections of the grid based on interpreted density values.

77. The method of any of claims 71 to 76, wherein determining step comprises the step of:

repeatedly determining an obstacle-free path between the identified obstacle structures.

78. The method of any of claims 71 to 77, wherein the guiding step comprises the steps of:

an operator guiding the object in accordance with the obstacle-free path; and

indicating to the operator whether the object is being guided in accordance with the obstacle-free path, such as to enable the operator to guide the object in accordance with the obstacle-free path.

79. The method of claim 78, wherein the indicating step comprises the step of:

providing a first indication where a location and/or angle of approach of the object is close, preferably within a predetermined limit, to an edge of a window as defined by the obstacle-free path.

80. The method of claim 79, wherein the indicating step comprises the step of:
providing a second indication where a location and/or angle of approach of the object is outside a window as defined by the obstacle-free path.

81. The method of any of claims 71 to 77, wherein the guiding step comprises the step of:
automatically guiding the object in accordance with the obstacle-free path.

82. The method of any of claims 71 to 81, wherein the at least one emitter array and the at least one receiver array are implemented in a single array element.